

The present amendment is filed in response to the Office Action of January 16, 2002. In the coversheet of the Office Action, all of pending claims 1 and 14-23 are characterized as rejected. Yet in the body of the Office Action, no rejection is specified for pending claim 1. In the first paragraph of the Office Action, the restriction of record is incorrectly characterized as electing claims 14-23 for continued prosecution; in reality the election of record elected claims 1 and 14-23 for continued prosecution. Thus, Applicants are unclear on the status of pending claim 1.

In the body of the Office Action, claims 14-23 stand rejected under 35 USC 102 in view of the Neudeck et al patent (USP 5,273,921, "Neudeck"). In response, Applicants respectfully submit that Neudeck neither teaches nor suggests the invention as set forth in claims 14-23. Moreover, while the status of claim 1 is unclear, Applicants respectfully submit that Neudeck neither teaches nor suggests the invention as recited in claim 1. The reasons for these positions are set forth below.

In general, with reference to Fig. 1H, Neudeck teaches a "vertical" double gate FET in which the channel region 18 sits atop a first gate electrode 14, and below a second gate electrode 20. Channel region 18 is epitaxially grown from an underlying silicon source 11. Source and drain regions 31, 32 are epitaxially grown from the channel region 18, and apparently are implanted to form LDD structures 31A, 32A adjacent the channel region. Note that Neudeck teaches that an advantageous feature of the structure is that the lower gate 14 is longer than the upper gate 20 to decrease parasitic capacitance (see Col. 5, line 67 - Col. 6, line 10).

The invention relates to a "horizontal" structure, in which a channel region is epitaxially grown from a side of a silicon layer, and the silicon layer is subsequently removed and the gate electrode is formed over the channel region. In Neudeck the channel is not epitaxially grown from a side of a silicon source that is subsequently removed. Channel 18 is grown from a top surface of the silicon source 11, not a side surface. Moreover, because layer 11 is the underlying substrate, it cannot be removed. The resulting channel region in the invention is a thin silicon layer that is surrounded on at least its sidewalls by a gate electrode. Such a structure is neither taught nor suggested by Neudeck; there the gates are above the top and below the bottom of the channel, not

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on its sidewalls.

Turning first to claim 1, notwithstanding the lack of a specified prior art rejection, applicants shall address the differences between the invention as recited in claim 1 and the Neudeck reference. Note that claim 1 specifies that the channel region is epitaxially grown on a side surface of a silicon source. As noted above, this step is neither taught nor suggested by Neudeck. The claim further specifies that the gate electrode is formed adjacent a sidewall of the channel region. In Neudeck the gates are formed above and below the channel region, not on a sidewall thereof. The invention features a sidewall-grown channel with sidewall-disposed gates; Neudeck features a bottom-grown channel with gates on upper and lower surfaces. Nowhere does Neudeck suggest that the channel could be epitaxially grown from the side surface of a silicon source that is subsequently removed, nor that the gate electrodes be formed adjacent the sidewalls of the channel. As such, applicants respectfully submit that Neudeck neither teaches nor suggests the invention as recited in claim 1. In passing, applicants have amended claim 1 to eliminate unnecessary language; such amendments are not made to address any rejection of record or to further distinguish from Neudeck.

Considering claim 14, again note that the claim specifies the formation of first and second epitaxially-grown channel regions, and that the gate contacts side surfaces of the channel region. Neudeck does not show plural channels, only one. Moreover, in claim 14 the source and drain regions are recited as being etched from a silicon layer, such that they abut the epi channel. In Neudeck the source and drains are epitaxially grown, there is no etch process taught in connection with forming the source and drain regions. In addition, the gate electrodes of Neudeck are not formed on sidewall surfaces of the channel region, as recited. Applicants respectfully submit that these claimed features patentably distinguish from Neudeck, and as such the rejection of record as to claim 14 has been traversed.

With reference to claim 15, in addition to incorporating the aforementioned distinguishing features of claim 14 from which it depends, note that claim 15 recites the creation of silicon lines, on which etch stop layers are formed, and on which the epi channels are formed. Neudeck neither

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teaches nor suggests any of this. Neudeck grows the channel region 18 from the underlying silicon 11. There are no "lines" from which the epi channel regions are grown; there is no etch stop layer grown on a "sidewall" of the "lines"; and there are no "lines" that are "etched away," as recited. In the Office Action the Examiner suggests that the recited "etch stop" can be read on layer 16 (Fig. 1B). However, the etch stop 16 is not formed on a sidewall of a silicon source, as recited; rather it is separated from the silicon source by oxide 12. Applicants respectfully submit that these claimed features patentably distinguish from Neudeck, and as such the rejection of record as to claim 15 has been traversed. In passing, applicants have amended claim 15 to eliminate unnecessary language; such amendments are not made to address any rejection of record or to further distinguish from Neudeck.

Applicants respectfully submit that the foregoing comments as to claims 14 and 15 apply to claims 16 through 20, since they are dependent on claim 15. As such, applicants respectfully submit that the rejections of record as to claims 16-19 have been traversed.

With reference to claims 20 and 21, in addition to incorporating the distinguishing features of the claims on which they depend, these claims recite the particular angles at which the implants are carried out. The Examiner suggests that these claims read on Neudeck. However, applicants respectfully point out that in Neudeck no angles are specified for any of the implants taught therein. Rather, the depiction of the implant regions in Fig. 1H strongly suggests a straightforward implant at 90 degrees relative to the horizontal surface of the substrate, not the specific angles recited in claims 20 and 21. As such, applicants respectfully submit that the rejections of record as to claims 20 and 21 have been traversed. In passing, applicants have amended claims 20 and 21 to properly draw their dependency to antecedent implant steps in claim 19, and claim 19 has been amended to draw its dependency from claim 14.

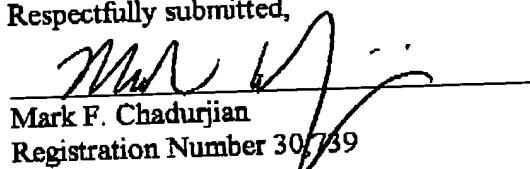
Finally, Applicants respectfully submit that the foregoing comments as to claims 14 apply to claims 22 and 23, since they are dependent on claim 14. As such, applicants respectfully submit that the rejections of record as to claims 22 and 23 have been traversed.

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Applicants have submitted claims 24-30 to further recite the invention. Applicants respectfully submit that these claims do not recite new matter, and they incorporate one or more of the above-discussed features of the invention that distinguish from Newdeck. Accordingly, applicants respectfully submit that newly-submitted claims 24-30 are patentable over the art of record.

In view of the foregoing, applicants respectfully submit that all of claims 1 and 14-30 as submitted herein recite patentable subject matter, and accordingly they earnestly solicit passage of the subject US patent application to issuance in view thereof. The proffered amendments are further indicated in blackline form in Exhibit A attached hereto. Should the examiner have any comments, questions, or suggestions, he is urged to contact the undersigned attorney at the telephone number or email listed below.

Respectfully submitted,

  
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